

NIH Launches Genes and Environment Initiative

The NIEHS and its fellow NIH institutes and centers have joined forces to reveal still more connections between genes, the environment, and human health. On 6 February 2006 Health and Human Services Secretary Mike Leavitt announced that the Genes and Environment Initiative (GEI) would receive \$68 million in fiscal year 2007, a \$40 million increase above the funding already planned for these NIH research efforts. The GEI will seek to speed up research to uncover the genetic roots of common human diseases such as asthma, arthritis, and Alzheimer disease.

"This initiative would not have been possible a year or two ago," said NIH director Elias Zerhouni in an announcement of the initiative's launch. "This is a tangible result of the nation's increased investment in medical research over the past ten years. . . . We stand on the threshold of creating a future that will revolutionize the practice of medicine by allowing us to predict disease, develop more precise therapies and, ultimately, preempt the development of disease in the first place."

The GEI will be managed by a coordinating committee headed by NIEHS director David A. Schwartz and Francis S. Collins, director of the National Human Genome Research Institute.

The proposed federal funding will enable the GEI to perform genotyping studies for several dozen common diseases, which will be selected by peer review. The NIH also expects to invest in and develop four new environmental monitoring tests and devices each year to measure toxicant exposures, dietary intake, and physical activity, and to determine individuals' biological responses to those influences. Eventually these new tools may be applied to population studies to speed up data processing, enhance data accuracy, and reduce costs. The National Center for Biotechnology Information, a part of the National Library of Medicine,

will develop databases to manage the vast amount of genetic, medical, and environmental information that is expected to be generated from the initiative.

At a press conference announcing the GEI, Schwartz said the new monitors will focus on more precise measures of environmental exposure, giving researchers an edge in determining how risk factors interact with specific genotypes to either maintain health or lead to disease. "This is a whole program," he says. "This is a puzzle [of] understanding the relationship between genetic variation and environmental variation, and the more that we can inform environmental variation as the genetic studies move along, the more we'll understand why certain individuals develop disease."

Brenda Weis, senior science advisor at the NIEHS, sees great potential in the new research effort. "It is my belief that the GEI will accelerate the pace of discovery about the role of genes and the environment in the development of human disease," she says. "The GEI builds on the knowledge gained through the Human Genome Project and the HapMap Project, and will provide, for the first time, personalized measures of exposure with the same level of precision as we have for genomic analyses."

—Tanya Tillett

BEYOND THE BENCH

Keeping Kids' Environments Safe

A safe home environment is the first line of defense in protecting children's health. And since many kids spend a great amount of time in schools and child care facilities, safeguarding their health in those places is also essential. The Community Outreach and Education Core (COEC) of the Environmental Health Sciences Center in Molecular and Cellular Toxicology with Human Applications at Wayne State University, in collaboration with the Detroit Head Start and the EPA, has developed the Healthy Homes = Healthy Kids Train-the-Trainer Program to ensure that parents and other caregivers receive information that allows them to create a hazard-free atmosphere for kids. These participants can then pass information along to other parents and caregivers. By training the trainer, the program ensures that a larger number of teachers and caregivers, and ultimately, children can be effectively reached and introduced to the basic concepts of environmental health science.



Taking better care of kids. The Healthy Homes = Healthy Kids Train-the-Trainer Program was developed to introduce parents and caregivers to environmental hazards in children's indoor environments and provide them with information on how to avoid such hazards and improve children's health.

Participants in the workshops are introduced to common household safety issues including toxic heavy metals (such as lead and mercury), indoor air pollutants (such as mold, asthma triggers, and combustion by-products), drinking water quality, food safety, pest control, and poisonous substances (such as medications, perfumes, and dish detergents) that children could mistake for food or drink.

Next, the participants learn about the health effects of these hazards, and are taught healthy practices to follow in the home, available methods for detecting and screening for poisonings, and ways to tap into additional local, state, and national resources. The program also provides hands-on activities for the participants that let them practice reacting to possible hazardous situations, such as finding a child playing with a toxic household cleaner.

The content of each workshop covers about six hours, but can be broken up over several days if needed. Program developers use pre- and post-tests to measure knowledge gained by participants, and also conduct follow-up surveys to gauge the effectiveness of the program and track how much the information is being used by workshop attendees. In addition to hands-on training, the program also provides a poster that highlights the hazards discussed in the sessions and a variety of fact sheets detailing common environmental hazards and prevention strategies. The fact sheets and poster are all available in English, Spanish, and Arabic.

The COEC recognizes the importance of community partnerships in providing effective outreach initiatives, and credits its outreach partners with helping keep the program responsive and successful. Train-the-trainer workshops have been conducted at Head Start in Detroit and the nonprofit Child Care Coordinating Council of Detroit/Wayne County.

"The COEC, through interactions and input from community groups . . . utilizes the scientific knowledge and research of center members to provide assistance to the community through education, prevention, and resource identification," says COEC project coordinator Lisa Pietrantoni.

Materials for the program are continuously updated as new information becomes available, and new topics are currently being developed. A total of 174 caregivers have been trained so far, and additional training sessions are scheduled for this spring. —Tanya Tillett

Headliners

NIEHS-Supported Research

Environmental Tobacco Smoke



Respiratory Effects Linked to Genetic Susceptibility

Wenten M, Berhane K, Rappaport EB, Avol E, Tsai W-W, Gauderman WJ, et al. 2005. *TNF-308* Modifies the Effect of Second-Hand Smoke on Respiratory Illness-Related School Absences. *Am J Respir Crit Care Med* 172:1563–1568.

Children are at special risk for adverse effects from exposure to secondhand smoke (SHS). Estimated population-attributable risks for SHS exposures in children range from 9% for asthma prevalence to 25% for hospital admissions due to lower respiratory symptoms. According to the Third National Health and Nutrition Examination Survey, 43% of children between the ages of 4 and 11 years are exposed to SHS at home. Now NIEHS grantees Frank D. Gilliland, Rob McConnell, W. James Gauderman, Louis Dubeau, Edward Avol, and Kiros Berhane, with their colleagues at the University of Southern California Keck School of Medicine, have shown that children with a particular genetic makeup are at a substantially greater risk for respiratory illness when exposed to SHS.

Using data from the Children's Health Study, the team examined school absences for 1,351 fourth grade students from 27 California elementary schools between January and June 1996. They categorized illness-related absences as being due to nonrespiratory or respiratory illness, then divided the latter into upper respiratory illness (runny nose/sneezing, sore throat, earache) or lower respiratory (wet cough, wheeze, asthma). They also gathered information on the students' health history, including history of asthma, and their exposure to smoking and allergens at home.

The researchers also collected buccal cells from each subject, to determine the student's tumor necrosis factor (TNF)- α genotype. TNF- α is an important cytokine in the inflammatory response to SHS. The *TNF* gene has a common variant in the promoter region G-308A that has been associated with TNF- α expression regulation in some studies.

Students who were exposed to SHS at home had a 51% greater risk of having a lower respiratory illness-related school absence compared with unexposed students. The association was clearest in students who had at least one copy of the variant A allele on *TNF*-308. Students who displayed the AA or AG genotype had a 75% increase in risk of illness-related absences of any kind. Those children possessing the A variant who were exposed to SHS at home had an even more pronounced risk for respiratory illness-related absences, especially absences due to lower respiratory illness. When compared to nonexposed children with the GG genotype, children with the A allele who were exposed to two or more smokers in the home were four times as likely to stay home because of lower respiratory illness.

The researchers postulate that variations in the *TNF* gene might intensify the body's inflammatory response to oxidative stress caused by cigarette smoke. They also note that since a significant number of people are exposed to SHS, future studies should focus on identifying genetically susceptible groups so actions can be taken to reduce their exposure. —Tanya Tillett